

REMARKS

The Invention

The invention provides a continuous process to form aluminum alloy of either T or O temper on a single machine. The method includes the step of providing a continuously-cast aluminum alloy strip as feedstock; quenching the feedstock to a preferred hot rolling temperature; hot or warm rolling the quenched feedstock to the required thickness, annealing or solution heat-treating the feedstock in-line depending on whether a T or O temper is desired, optionally quenching the feedstock, tension leveling and coiling. With this method, both T and O tempers can be made in the same line. T tempers are formed through the use of solution heat treating the feedstock, while O tempers are formed through annealing. Afterwards, the feedstock is warm coiled for an O temper, or quenched and coiled for a T temper. The invention creates T and O tempers from the above process as defined by the Aluminum Association.

Claims 1, 4-7, 10-13, 15-18, 21 and 22; Rejected Under 35 U.S.C. § 102(b) by United States Patent 5,769,972 to Sun

The above claims are rejected under 35 U.S.C. § 102(b) as being anticipated by Sun. Sun is cited for teaching a process of manufacturing an aluminum alloy sheet stock by continuously casting a strip, hot rolling the strip, and annealing the strip.

While Sun teaches casting, hot rolling and annealing, it does not recite a quenching step in-between the casting of the strip and the hot rolling of the strip, as currently claimed in Applicant's amended claim 1. In fact, it specifically disavows it as being thermodynamically inefficient. See Col. 2, ll. 43-56. Since Sun no longer contains every limitation of Applicant's amended claim 1, it can no longer be used as a § 102 reference. As claims 4-7 and 10-13, 15-18, 21 and 23 depend from independent

claim 1, these claims are similarly not anticipated by Sun. Related rejections based on §103 are discussed below.

Applicant further notes that Sun does not provide a process for making either T or O temper alloy sheets in a single in-line process, as it does not provide for solution-heat treating in-line. In the present invention, both T and O tempers can be made in the same line. T tempers are formed through the use of solution heat treating the feedstock, while O tempers are formed through annealing. Afterwards, the feedstock is warm coiled for an O temper, or quenched and coiled for a T temper. Sun does not provide for the formation of both T and O formations, or, for that matter, either. Thus, Sun does not anticipate the present invention under § 102. As claims 4-7 and 10-13, 15-18, 21 and 23 depend from independent claim 1, these claims are similarly not anticipated by Sun.

Claims 1, 4-7, 10-13, 15-18, 21 and 22; Rejected Under 35 U.S.C. § 102(b) by United States Patent 5,514,228 to Wyatt-Mair

The above claims are rejected under 35 U.S.C. § 102(b) as being anticipated by Wyatt-Mair. Wyatt-Mair is cited for teaching a method comprising the steps of a continuously presenting an alloy strip, hot rolling the strip and annealing the strip. Like Sun above, however, Wyatt-Mair does not recite a quenching step in-between the casting of the strip and the hot rolling of the strip, as currently claimed in Applicant's amended claim 1. In fact, it specifically notes that the strip must move directly from the casting process into an anneal. See Col. 6, ll. 6-26. Further, Wyatt-Mair does not teach the formation of both T and O tempers on the same continuous line. Since Wyatt-Mair no longer contains every limitation of amended claim 1, it can no longer be used as a § 102 reference. As claims 4-7 and 10-13, 15-18, 21 and 23 depend from independent claim 1, these claims are similarly not anticipated by Wyatt-Mair.

Further, Wyatt-Mair only teaches the formation of Aluminum Association defined T or O tempers with the use of cold rolling after annealing. While Wyatt-Mair notes that cold rolling after annealing is optional, if the procedure described by Wyatt-Mair was done without the final cold rolling, the final product of the process would be undefined by the Aluminum Association as a T or O temper. One novel part of Applicant's invention, a surprise advancement over the prior art, is that T or O defined tempers can be created without cold rolling after annealing or solution heat treating. This is because the present invention provides a rapid in-line process where the feedstock is cast, quenched, and immediately fed into a hot or warm roller. Essentially, the science behind this is that the solute (magnesium, silicon, etc.) of the invention generally remains dissolved in solvent (aluminum) for the entirety of the process, wherein any solute that fall out of the resultant solution can immediately be re-dissolved during the annealing or solution heat treating process. Related rejections based on §103 are discussed below.

Claims 2 and 8 are rejected under 35 U.S.C. 103(a) over Sun.

The Examiner notes that Sun discloses that it is known in the art to quench after casting and prior to hot rolling. Thus, the Examiner reasons, Applicant's first quenching step must be known in the art. However, the Examiner misstates the disclosure of Sun. Sun states that the "omission of the first quenching step represents more efficient utilization of energy since it is not necessary to reheat the feed stock to the desired annealing temperature after it has been cooled[.]" This statement does not make Applicant's first quenching step obvious in view of the disclosed prior art. First, Sun does not state whether or not the quenching occurs prior to hot rolling, only that the quenching occurs prior to annealing. Thus, it is not necessarily clear that quenching prior to hot rolling is disclosed.

Second, Sun clearly states that in the prior art, a re-heating of the feedstock is necessary prior to the annealing. For this very reason, as noted by the Examiner, the quenching is dismissed for being thermodynamically inefficient. However, in the present invention, reheating is not necessary. The quenching is controlled to the

desired hot rolling temperature. Since the prior art procedure disclosed in Sun is not the same as the procedure claimed in the amended claims of the present invention, it would not be obvious to quench a feedstock after its formation and immediately feed it into a hot rolling station unless it was reheated prior to entry into the hot roller. Further, Sun states that doing such quenching and reheating makes it difficult to produce a continuous-in-line sequence of events, something that is achieved in the present invention.

Additionally, like Wyatt-Mair above, Sun also only teaches the formation of Aluminum Association defined T or O tempers with cold rolling after annealing. While Sun notes that cold rolling after annealing is optional, if the procedure described by Sun was done without the final cold rolling, the final product of the process would be undefined by the Aluminum Association as a T or O temper. One novel part of Applicant's invention, a surprise advancement over the prior art, is that T or O defined tempers can be created without cold rolling after annealing or solution heat treating. This is because the present invention provides a rapid in-line process where the feedstock is cast, quenched, and immediately fed into a hot or warm roller.

Claims 2 and 9 are rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair et al.

The Examiner states that both Sun and Wyatt-Mair both have prima-facie evidence of quenching. Essentially, the Examiner states that since the temperature of the hot rolling in the prior art occurs at a temperature less than the temperature of casting, cooling must have occurred at somewhere thereabouts. Applicant believes this thinking is logically flawed. First, Applicant claims quenching – not cooling. Quenching by its definition refers to a cooling fluid, either in liquid or gaseous form, sprayed on a feedstock to reduce temperatures. See Spec, Pg. 6, ll. 13-19. Thus, quenching can control the cooling level. Cooling merely due to standard loss of temperature in the general course of moving, which the Examiner improperly equates with quenching, is a different idea entirely. It is not quenching as much as uncontrolled cooling based on thermal properties of the alloy and the dissipation of heat.

Additionally, the ranges cited by the Examiner to show that the hot rollers are utilized at temperatures less than the temperatures of casting are just that- the temperatures of the hot roller. The Examiner seems to be suggesting the hot rollers perform as a coolant in addition to performing as a roller, i.e., both steps are performed at the same time. However, Applicant's claim clearly states that the first quenching happens in between the casting and rolling. This cannot be achieved if the rolling is also the quenching means. Thus there is no prima facie quenching disclosed, and Sun and Wyatt-Mair do not make the Applicant's invention obvious.

Claims 2 and 8 are rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair et al. in further view of Zonker.

Zonker discloses a process for continuously casting a flat rolled sheet, hot rolling the sheet, and further processing the sheet with a combination of cold rolling and heat treatments to produce a final sheet.

Unlike the present invention, however, Zonker does not produce Aluminum Association defined O and T alloys. Instead, it is directed toward batch stabilized sheet precuts. See Col. 5, ll. 17-22 (See also claim 1). Considering the intentions, it does not seem obvious that one skilled in the art would utilize procedures designed for precuts for the productions of T and O tempers.

Further, Zonker discloses a process so dissimilar from the method claimed in Applicant's amended claims that it would not be obvious to hijack one part of the process to include in Applicant's current method. For example, the Examiner notes that the alloys were quenched after casting. However, the process that Zonker teaches is to quench the alloys down to room temperature (as opposed to between 400-900F, as in the present claim 8), and then reheated to 510 degrees prior to hot rolling. Further, after hot rolling, the alloys were slow cooled at a rate of 10C/hr. The alloys were then non-flash annealed for a length of 2-3 hours.

From the above, Zonker clearly describes a non-in-line process considerably longer and entirely different than Applicant's invention. Regarding the quenching, Applicant's invention does not involve quenching to anywhere close to room temperature, and does not require, or desire, reheating of the quenched body sheet prior to hot rolling. It strains belief that one skilled in the art would know to take the lengthy, non-in-line process of Zonker and steal the quenching-reheating step, but only after the removal of the reheating step and reduction of the quenching step. Applicant's amended claims are not obvious over the claimed references.

Claim 3 is rejected under 35 U.S.C. 103(a) over Sun or Wyett-Mair in further view of United States Patent No. 5,106,429 to McAuliffe.

McAuliff teaches a process wherein an alloy of a particular composition is cast into a cast strip, hot rolled, annealed, cold rolled and tension leveled. See Col. 6, ll. 51-53. According to McAuliff, the cold rolling reduces thickness, provides better uniformity (Col. 8, ll. 13-15,) reduces earing (Col. 8, ll. 45-47,) and stabilizes (Col. 8, ll. 58-60.) The stabilization reduces the physical properties of the aluminum so that the aluminum sheet will not experience any substantial decrease in strength during subsequent processing. See Col. 9, ll. 7-10. The tension leveling achieves a more uniform flatness after the final cold rolling pass. Col. 23, ll. 11-14.

Thus, McAuliff teaches tension leveling only after the stabilizing effects of cold rolling. In contrast, the present invention does not utilize cold rolling immediately prior to tension leveling. It would not be obvious for one skilled in the art to use tension leveling strip immediately after annealing or solution heat treating without stabilizing the alloy with cold rolling as is taught in McAuliff.

Claims 14 and 19 are rejected under 35 U.S.C. 103(a) over Sun or Wyett-Mair in further view of "ASM Handbook: Vol. 4 Heat Treating" pp. 851-857.

The ASM handbook teaches air quenching following a solution heat treatment step. For an alloy like 6022, that would require temperatures in the range of 1060°F with a duration on the order of one minute. In the present invention, such high temperatures and duration are not used. Thus, combining the two references would not result in the present invention; therefore there can be no obviousness rejection.

Further, the ASM handbook does not teach or make obvious the invention as claimed in the Applicant's amended claims, wherein an aluminum alloy sheet in a continuous in-line process is continuously cast, quenched to a preferred hot rolling temperature, hot or warm rolled, and annealed or solution heat-treated in-line depending on the alloy and the T or O temper desired, as claimed in Applicant's amended claim 1. Therefore, as they depend from claim 1, claims 20 and 26 are not obvious over the above reference.

Claims 20 and 26 are rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair.

Sun teaches a final cast thickness similar to that of the present invention. However, Sun does not teach or make obvious the invention as claimed in Applicant's amended claims, wherein an aluminum alloy sheet in a continuous in-line process is continuously cast, quenched to a preferred hot rolling temperature, hot or warm rolled, and annealed or solution heat-treated in-line depending on the alloy and the T or O temper desired, as claimed in Applicant's amended claim 1. Therefore, as they depend from claim 1, claims 20 and 26 are not obvious over the above reference.

Claims 23-25 are rejected under 35 U.S.C. 103(a) over Sun or Wyatt-Mair in further view of United States Patent No. 5,833,775 to Newton.

Newton teaches method for producing an aluminum sheet having additional cooling, annealing and quenching steps. However, Newton does not teach a rapid, continuous in-line process. See the examples of Newton. Instead, Newton requires the

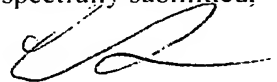
intermediate annealings to be about 1 to 3 hours and all the intermediate coolings to be roughly 48 hours. See Col. 14, ll. 1-44. The present invention teaches a rapid, in-line continuous method. It would not be obvious for one skilled in the art to take the cooling steps of Newton, which requires 48 hours to cool, or additional annealing, which takes 1-3 hours, and to place them in a continuous, in-line system.

Further, Newton, in combination with Sun or Wyatt-Mair, does not teach or make obvious the invention as claimed in Applicant's amended claims, wherein an aluminum alloy sheet in a continuous in-line process is continuously cast, quenched to a preferred hot rolling temperature, hot or warm rolled, and annealed or solution heat-treated in-line depending on the alloy and the T or O temper desired, as claimed in Applicant's amended claim 1. Therefore, as they depend from claim 1, claims 20 and 26 are not obvious over the above reference.

CONCLUSION

It is submitted that the present amendment obviates the rejections under 35 U.S.C. § 102, and that the present invention is not made obvious under 35 U.S.C. § 103 by the cited references. Applicant respectfully submits that the application is now in proper form for issuance of a Notice of Allowance and such action is requested at an early date.

Respectfully submitted,



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